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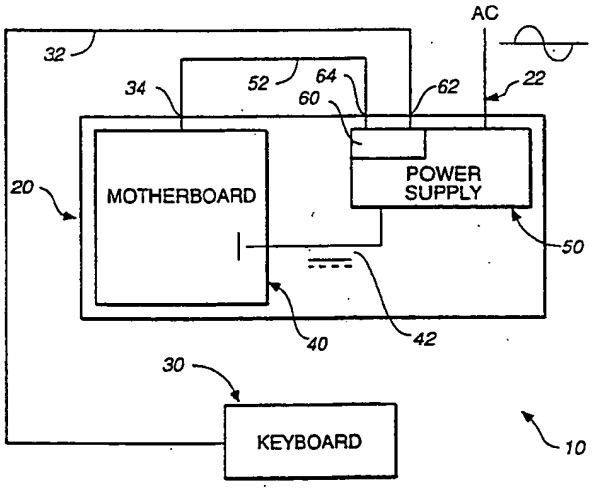

(57) Abstract

An intelligent power supply is disclosed for use with a computer system having an external keyboard connected to the computer system by means of a keyboard input connector. The power supply includes a primary power supply and a power controller for controlling and monitoring operation of the primary power supply. The power supply further includes a connection interface for connecting the power controller between the keyboard and the keyboard input connector of the computer such that normal data transmission between the keyboard and the computer system is not affected and such that control signals may be transmitted from the keyboard to the power controller. The power controller is responsible to those control signals from the keyboard to control the operation of the primary power supply. The power controller may be separately powered by a secondary power supply.

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INTELLIGENT POWER SUPPLY

FIELD OF THE INVENTION

The present invention relates generally to the field of supplying power to a computer system, and more particularly to an apparatus for controlling and monitoring application of power to a computer system.

BACKGROUND OF THE INVENTION

All computer systems require some apparatus for providing the electrical power necessary to operate the system. Typically this power is supplied by a power supply unit located within the main computer enclosure, and provides either AC to DC or DC to DC power conversion within a predetermined power specification range. This power is ordinarily supplied directly to the computer's motherboard, which contains the central processing unit (CPU). Power from the power supply may also be provided directly to peripheral units such as mass storage devices, video monitors or input/output (I/O) devices.

Control of these power supplies is typically limited to a master ON/OFF electrical switch, which may be implemented as a toggle switch or as a low-current/low-voltage pushbutton ON/OFF switch.

The desire for greater control over and monitoring of the power of a computer's power supply has led to the development of sophisticated power supplies which include on board power supply microprocessors or controllers which provide status displays and may include multiple external control switches. Users may input commands to these power supply controllers either from such external switches or from software commands received from the computer itself. These power supplies typically are external

to the computer in order to provide access to the control switches and displays, and typically are secondary power sources. Any communication with the computer is obtained via a dedicated serial port.

Such a more sophisticated power supply could be designed in conjunction with a computer to enable it to be located inside the computer. This would require a redesigned computer enclosure and motherboard to allow user access to the additional switches and displays. Hence, a drawback of such an improved power supply would be its unavailability for existing computer systems and thus its limited availability to most computer users.

In general, the ability to program a power supply's controller is limited by the number and location of the control switches and the ability of the controller to communicate with the computer motherboard itself. Direct communication between a power supply and the computer motherboard impairs system function by requiring greater use of valuable communications and processing resources for computer housekeeping functions.

There are a number of occasions when greater control of the power supply is desired. For example, many desktop computer users also use a portable computer while performing work in a remote location. It is often desirable for the user to access information stored in the desktop computer's hard drive or other mass storage device. Several commercially successful software packages permit such remote access to the desktop computer. Unfortunately, the desktop computer's power supply must remain continuously active for this software to function. This is undesirable because the idle computer continues to use power. In addition, the power supply for the desktop computer may either be intentionally or unintentionally inactive when the user desires access. Similarly, it may be desirable for one computer in a network of computers to activate an inactive computer.

There are other occasions when greater control of the power supply is desirable. There are many computer applications which may be run at lower cost or with less intrusion into critical applications at non-peak hours, which are typically when the computer is unattended. Some examples of such applications are hard drive backups, system diagnostics, remote file transmission during low connect charge rate periods, and transmission of facsimile documents during low telephone connect charge rate periods. Presently, there is commercially available software which can perform these tasks, but all such software again requires that the computer be powered in order to function.

In addition, greater control of the power supply could allow for optimal power transmission based upon usage. For example, computers often remain idle for prolonged periods, during which time power is supplied to the computer. It would be desirable to selectively reduce or eliminate power to the computer during such periods. Typical prior attempts to provide this advantage have focused upon forcing specific components to enter a low power usage idle state when not in use while other components remain active. The known prior art has not addressed, however, termination of primary power to the entire computer system based upon general inactivity.

Another area in which increased control of the operation of the power supply is desirable is in the area of computer system security. There are presently two approaches used for preventing access to a computer by an unauthorized user. First, a physical lock can be used which prevents input of information to the keyboard. This approach is unpopular because the user or other authorized personnel would be required to carry copies of the key in order to ensure the ability to reactivate the system. Second, a password may be used in conjunction with software resident in the computer. Such software can often be easily defeated. Neither of these methods prohibits an

unauthorized user from activating the computer's power supply.

In addition to the need for increased control of the power supply, there is a need for increased information regarding the status of the power supplied by the power supply. Such status information may include for example, the detection of a low voltage or "brown out" state which could adversely affect operation of the computer. In addition, such status information may include valuable diagnostic and predictive information which would allow the user to anticipate an impending catastrophic failure of the power supply. Such a failure may result in interruption of the power supplied and thus deactivation of the computer at a critical time period for the user. In addition, such a failure may result in loss of valuable information to the user. Presently, computer users can use an Uninterruptible Power Supply (UPS) to protect against such failure. Nevertheless, the UPS has limited ability to power the computer for extended periods, which may be required for some computers running key applications. It would be desirable for the user to have advance warning of such impending failure, which would allow the user to determine the time when the computer would be serviced or to allow the user to save active work if the failure is imminent or if the UPS power is degrading. Such a warning could also be requested periodically if the initial warning is ignored and the risk of impending failure still exists. It would also be desirable for the designers of computer power supplies to have available such information regarding the operating status of a defective power supply prior to its failure, to allow the designers to improve upon their designs and thereby provide improved power supplies in the future.

It is therefore desirable for a power supply to have a controller and monitoring device which may be utilized within existing computers without requiring that the computer be substantially redesigned or reconfigured. Such a controller should be able to obtain commands from the existing computer

keyboard without requiring those commands to be processed by the motherboard. Such a controller should also be capable of bidirectional communication with the computer's motherboard for receiving commands from the computer's central processor and for enabling status information to be transmitted to the central processing unit.

According, it is an object of the present invention to provide an improved computer power supply.

Another object of the present invention is to provide a computer power supply controller which may be programmed directly from the computer's keyboard without requiring commands from the computer's motherboard.

A further object of the present invention is to provide a computer power supply controller which may be incorporated into existing computer systems without modification of the motherboard or the enclosure.

A still further object of the present invention is to provide a computer power supply which provides a range of control and diagnostic features.

Yet another object of the present invention is to provide a computer power supply which is capable of bidirectional communication with the computer's motherboard.

A still further object of the present invention is to provide a computer power supply with internal software password protection to activate or deactivate the power of the computer.

Another object of the present invention is to provide a computer power supply which may be activated by remote devices.

Yet another object of the present invention is to provide a computer power supply which may activate or deactivate the computer at predetermined times.

A still further object of the present invention is to provide a computer power supply which may deactivate the computer during long periods of time in which no user input is provided.

A further object of the present invention is to provide a computer power supply which provides warnings of failure or adverse power conditions to the user and permits user response thereto.

These and other objects of the present invention will become apparent to those skilled in the art from the following description and accompanying claims and drawings.

SUMMARY OF THE INVENTION

The present invention comprises an apparatus for use with a computer system having an external keyboard connected to the computer system by means of a keyboard input connector. The present invention comprises an intelligent power supply for powering the computer system. The power supply includes a primary power supply means. It also includes power control means for controlling and monitoring operation of the primary power supply means. The power supply further includes connection means for connecting the power control means between the keyboard and the keyboard input connector of the computer such that normal data transmission between the keyboard and the computer system is not affected and such that control signals may be transmitted from the keyboard to the power control means. The power control means is responsive to those control signals from the keyboard to control the operation of the primary power supply means. The power control means may be separately powered by a secondary power supply means.

In some preferred embodiments of the present invention, optional means of communication with the power control means may be utilized. For example, a control bus may provide communication directly between the power control means and the motherboard. Also, a telephone line interface or other means of receiving signals from a remote source may allow remote communication with the power control means. Further, a Mains Bourne Transmission (MBT) device may allow communication between the power control means and an external UPS.

In some preferred embodiments of the present invention, the power supply may include a timer, which would allow the power supply to be activated or deactivated at specific times, or if no user input to the keyboard is provided within a predetermined time interval.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a preferred embodiment of the present invention.

FIG. 2 shows a system schematic for the preferred embodiment of the controller 60 shown in FIG. 1 according to the present invention.

FIG. 3 is a flow chart for a "walkaway" deactivation feature according to one preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

A preferred embodiment of the present invention is illustrated at 10 in FIG. 1. Shown at 10 is a computer system comprising a computer 20 including an external keyboard 30 which is connected to the computer via a keyboard cable 32 and an input connection 34 on the rear panel of the computer. Computer 20 contains a motherboard 40, along with a power supply 50. Power Supply 50 receives an AC input via a power cord 22. Power Supply 50 converts this AC input signal into one or more DC outputs, and transmits this output over power connector 42 to motherboard 40.

The foregoing configuration is common to computer systems. Unlike prior art computer systems, power supply 50 of the present invention contains a controller 60 which is interposed between keyboard 30 and motherboard 40. Hence keyboard 30 is connected by connecting keyboard cable 32 to controller 60, via a connector 62 on power supply 50, and controller 60 is connected to motherboard 40 via a control cable 52 connected between an output connector 64 of power supply 50 and input connector 34.

Control connector 52 allows signals from the keyboard to pass to motherboard 40. With the proper selection of keystroke command signals, as described below, control signals from keyboard 30 are produced for controller 60 which do not interfere with data transmission from keyboard 30 to motherboard 40. In other words, according to the present invention, a user via keyboard 30 has direct command signal access to controller 60 without risk that such signals will interfere with the normal functioning of the computer. Hence, no additional control keys or switches are required to program or send commands to controller 60.

In addition, installation of a power supply according to the present invention does not require any modification to the computer. A user may simply substitute a pre-existing power supply with a power supply according to the present invention, disconnect the keyboard cable 32 from motherboard 40 and connect it to controller 60, and connect control cable 52 to the keyboard connector on the motherboard of the computer, or to an external keyboard port.

In order to ensure that keyboard data transmission is not impaired, the command set for controller 60 is designed to utilize data codes not generated by the keyboard. Typically, keyboards communicate with the computer's motherboard by means of codes generated by an encoder chip within the keyboard circuitry. For example, depressing the C key will cause the encoder to transmit the ASCII code "67" to the motherboard. Such codes are standardized for use by keyboard encoder integrated circuits, and hence the command set for controller 60 may be designed for use in a wide variety of computer systems which utilize keyboards containing those encoders.

By interposing controller 60 between the keyboard 30 and motherboard 40, improved computer security may also be provided.

Controller 60 may be configured to require entry on the keyboard of a password prior to activation of the power supply, or to block transmission of keystrokes to motherboard 40 in response to receipt of the password. The controller would thus continuously monitor the signals incoming from keyboard 30 to detect such passwords. The use of passwords to control power to the computer allows security protection for the computer without the computer being activated and without the need for a separate additional key device.

A preferred embodiment of controller 60 of FIG. 1 is illustrated in FIG. 2. Central to the controller 60 is a microprocessor 110. Because controller 60 must function when the computer system is deactivated, microprocessor 110 must be powered from a secondary power supply 176 or from an alternate power source such as an optional battery 116. Secondary power supply 176 draws power directly from the AC power cord 142, and hence requires connection to an AC power source to operate controller 60. Microprocessor 110 is also connected to an oscillator 114, which is needed to operate the microprocessor 110 and the real-time clock (RTC) 118. In the embodiment shown in FIG. 2, RTC 118 is incorporated into microprocessor 110, although a separate circuit may be utilized in alternative embodiments. In addition, microprocessor 110 may be equipped with a monitor control line 126 to control operation of a computer monitor.

Microprocessor 110 receives signals from external sensors (not shown) on input lines 120. Such sensors may measure parameters such as ripple current, +5V and +12V voltage levels, temperature and battery power levels. When these are input to microprocessor 110 on lines 120, they are converted from analog to digital signals by an analog-to-digital converter (ADC) 112 incorporated into microprocessor 110. Analog-to-digital conversion external to the microprocessor may also be used where the microprocessor does not have such a capability. Microprocessor 110 may also

produce status signals 122 based upon the signals received on input lines 120. For example, "FAULT" may indicate a problem with the power supply, "CHARGE" might indicate the charge status on a battery, and "POWER GOOD" might indicate that the measured voltages fell within a predetermined range suitable for operation of the computer. In addition, optional inputs 124 may be provided for use with other features not described therein.

Microprocessor 110 communicates with motherboard 40 of FIG. 1 through the keyboard connection 34, as discussed above. This connection may be implemented by means of a keyboard interface controller 150 which is capable of bidirectional communication with keyboard 30 via data lines 152 and motherboard 40 via data lines 154. Alternatively, an optional additional communication path may be provided through a conventional I^2C databus interface 130. Databus interface 130 is in communication with motherboard 40 via I^2C databus 134, which is connected to motherboard 40, as discussed above.

In either configuration, such communications allow motherboard 40 also to send control signals to microprocessor 110, and for microprocessor 110 to communicate data regarding the measured parameters described above to motherboard 40. The computer may then be equipped with software to process the data and either display it for the user or to record the data in a non-volatile memory source such as the computer's hard disk drive memory. In addition, such software could warn the user if any operational parameter deviates from a predefined range, to allow the user to avoid catastrophic power failure. For example, pre-failure warning messages may be displayed on the computer monitor alterting the user to imminent failure of the power supply or degradation of the UPS power output and giving the user the option to save active work or proceeding. Such a message may be repeated periodically if the condition persists. An automatic shutdown of the computer being powered by a UPS can also be

performed in a conventional fashion if the UPS backup power is about to fail, in order to save to non-volatile memory not only the contents of the computer's volatile memory but also the power supply status information, described above. This would also prevent drainage of the UPS battery and consequent damage.

Microprocessor 110 controls the AC power provided to the power supply as follows. A digitally controlled switch 140 is connected via switch line 146 to microprocessor 110. Switch 140 is interposed between the AC power cord 142 and the AC power supply input lines 144. Switch 140 responds to commands from microprocessor 110 to connect or disconnect power to the power supply.

Microprocessor 110 determines a need to make such a connection or disconnection in the following manner. A power switch 178 is provided on the power supply, which allows the user to activate or deactivate the computer manually. Such a power switch 178 may be implemented as a toggle switch or pushbutton switch, although alternatives will be obvious to those skilled in the art.

According to a preferred embodiment of the present invention, an optical additional means may be provided for activation of the power supply. A remote control switch 160 may be provided which is responsive to a signal on an external line 162 to activate the computer. Examples of such an external line 162 are a telephone line connected to a modern and a remote computer which is connected to the host computer system in a LAN (Local Area Network). This remote control switch 160 therefore functions to allow a remote user to activate the computer. Such an option would permit a user to access the computer remotely without the necessity of leaving the computer in an active state.

In addition, keyboard interface controller 150 may activate the power supply in response to keystrokes received from data lines 152. Keyboard interface controller 150 may

be programmed to cause such activation in response to a number of distinct triggering events, such as in response to any keystroke or only responsive to a specified series of keystrokes, i.e. a password.

Remote control switch 160 and keyboard interface controller 150 are connected to microprocessor 110 in the following manner. Keyboard interface controller 150 has a keyboard switch line 156 and remote control switch 160 has a control switch line 164 which meet in a node 166. Node 166 simply combines the signals, which pass over power control line 168 to microprocessor 110. In this configuration, the computer power supply connection is caused by microprocessor 110 to remain active while either the keyboard switch line or the remote control line remain active. Alternative connection configurations may be utilized, for example to allow manual override of the remote access in order to provide improved computer security from external tampering.

Microprocessor 110 may also be in communication with an external UPS 148 disposed between AC powercord 142 and AC power supply input lines 144. One preferred manner of communication utilizes the Mains Borne Transmission (MBT) approach, such as is disclosed in U.S. Patent No. 5,005,187. The details of this protocol are not discussed herein but are known to those skilled in the art. Such a system would include an MBT controller 170 connected to microprocessor 110 via a connector 172 and to an external UPS 148 via an external UPS power connection 174.

The use of a controller such as controller 60 of FIG. 1 provides increased flexibility of operation beyond that described above. For example, controller 60 may be equipped with a real-time clock (RTC) 118, as discussed above regarding microprocessor 110 of FIG. 2. Microprocessor 110 may be programmed to poll the real-time clock to activate or deactivate the computer at specified times. This feature would permit automated operation of the computer at desired times while allowing the computer to remain inactive during

the remaining time. For example, such a mode of operation would allow a computer to activate itself at a time at which the computer is known to be normally off, such as late at night, to perform a data backup or to transmit facsimile documents. Prior art methods of performing such functions require active power to the computer to initiate these activities.

An additional feature which may be programmed into controller 60 is illustrated in FIG. 3. In this method of operation, the computer may be deactivated if no operation is performed or user input received for a predetermined period of time. First, a register A in microprocessor 110 is programmed with a timer count, as shown at 210. Alternatively, the value could be stored in a memory location. Next, a timer register is programmed with the value from register A, as shown at 220. The input connector 62, which receives signals from keyboard 30 of FIG. 1, is then monitored for activity. At regular intervals the keyboard interface controller 150 of FIG. 2 is polled to determine whether any signal has been transmitted from keyboard 30 which would indicate that a key was pressed. This is shown in FIG. 3 at 230. If a key has been pressed, the timer register is reset at 220 and the process is repeated. If no key has been pressed, the timer register is decremented at 240 and is then compared to zero at 250. If the timer register is not yet at zero, operation returns to polling step 230. If the timer register is equal to zero, the computer is polled at 260 to determine if it is appropriate to deactivate. Such a polling will avoid deactivating the computer while it is performing a lengthy computational or input/output process which does not require user input. When the controller 60 determines that the computer should be deactivated, an instruction is sent to the computer to activate programming to save the status of the computer to non-volatile memory. After a sufficient period of time to allow for an orderly shutdown, the power supply is deactivated until the user reinitiates use. Examples of software to perform such an orderly shutdown are well known to those skilled in the art and may be found used in

conjunction with UPS's. Hence, all ordinary keyboard activity will become control signals to maintain activation of the computer power supply.

It will be obvious to those skilled in the art that the software necessary to perform the features described above may be resident in the computer memory itself and need not be found on the power supply controller.

While specific preferred embodiments of the elements of the present invention have been illustrated above, various modifications of the invention in addition to those shown and described herein will become apparent to those skilled in the art from the foregoing description and accompanying drawings. Such modifications are intended to fall within the scope of the following claims.

WHAT IS CLAIMED IS:

1. In a computer system having an external keyboard connected to the computer system by means of a keyboard input connector and an AC power cord for receiving power from an external source, an intelligent power supply for powering the computer system comprising:

primary power supply means for converting power received from the AC power cord of the computer into power usable by the computer system;

power control means for controlling and monitoring operation of said primary power supply means; and

connection means for connecting said power control means between the keyboard and the keyboard input connector of the computer such that normal data transmission between the keyboard and the computer system is not affected and such that control signals from the keyboard may be received by said power control means;

wherein said power control means is responsive to said control signals from the keyboard to control the operation of said primary power supply means.

2. The power supply of Claim 1 further comprising control bus means for providing communication between said power control means and the computer.

3. The power supply of Claim 1 wherein said connection means comprises a first power supply keyboard connector for connection to a cable

connected to the keyboard, a second power supply connector and a cable for connecting said power supply connector to the keyboard input connector of the computer system.

4. The power supply of Claim 1 further comprising a secondary power supply means for powering said power control means independently from said primary power supply means.

5. The power supply of Claim 3 wherein said power control means includes means for storing and recognizing a password transmitted from the keyboard to activate the primary power supply and wherein said power supply further comprises secondary power supply means for providing power to the keyboard and power control means when said primary power supply means is inactive.

6. The power supply of Claim 1 wherein said power control means includes means for receiving signals from a remote source to control the operation of said primary power supply means.

7. The power supply of Claim 1 wherein said power control means includes timer means for controlling operation of said primary power supply means to enable said power supply means to be activated at a predetermined time.

8. The power supply of Claim 1 wherein said power control means includes timer means for controlling operation of said primary power supply means to enable said power supply means to be deactivated at a predetermined time.

9. The power supply of Claim 1 wherein said power control

means includes diagnostic means for obtaining status information regarding the operation of said primary power supply and for generating diagnostic information from said status information.

10. The power supply of Claim 9 wherein said power control means further comprises warning means for generating a warning signal to the computer in response to the diagnostic information generated by said diagnostic means.

11. The power supply of Claim 8 further comprising storage means connected to said power control means for storing selected samples of said status and said diagnostic information.

12. The power supply of Claim 1 wherein said power control means includes inactivity timer means for deactivating said primary power supply when no data signals have been received from the keyboard for a predetermined period of time.

13. The power supply of Claim 1 wherein said power control means includes means for bidirectional serial communication with an external Uninterruptible Power Supply through the AC power cord of the computer.

14. An intelligent power supply for powering the computer system having a keyboard and an AC power cord for receiving power from an external source, said power supply comprising:

primary power supply means for converting power received from the AC power cord of the computer into power usable by the computer system;

power control means for controlling and monitoring operation of said primary power supply means; and

receiver means for receiving control signals from the keyboard;

wherein said power control means is responsive to said control signals from the keyboard to control the operation of said primary power supply means.

15. The power supply of Claim 14 further comprising control bus means for communicating control signals for controlling said power control means from the computer to said power control means, said control bus means being separate from said connection means.

16. The power supply of Claim 14 further comprising a secondary power supply means for powering said power control means independently from said primary power supply means.

17. The power supply of Claim 14 wherein said power control means includes means for receiving signals from a remote source to control the operation of said primary power supply means.

18. The power supply of Claim 14 wherein said power control means includes timer means for controlling operation of said primary power supply means to activate said primary power supply means at a predetermined time.

19. The power supply of Claim 14 wherein said power control means includes timer means for controlling operation of said primary power supply means to deactivate said primary power supply means at a predetermined time.

20. The power supply of Claim 14 wherein said power control means includes inactivity timer means for deactivating said primary power supply upon determining that no data signals have been received from the keyboard of said computer for a predetermined period of time.

21. The power supply of Claim 14 wherein said power control means includes means for bidirectional serial communication with an external Uninterruptible Power Supply through the AC power cord of the computer.

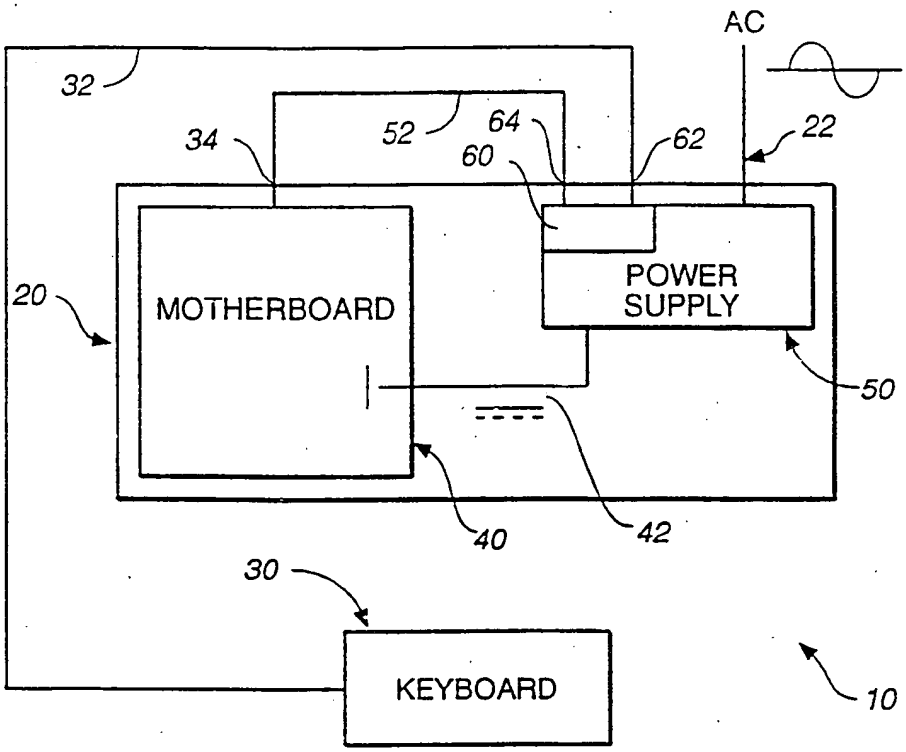
AC
32
34
52
64
60
62
22
MOTHERBOARD
POWER SUPPLY
20
50
40
42
30
KEYBOARD
10

FIG._1

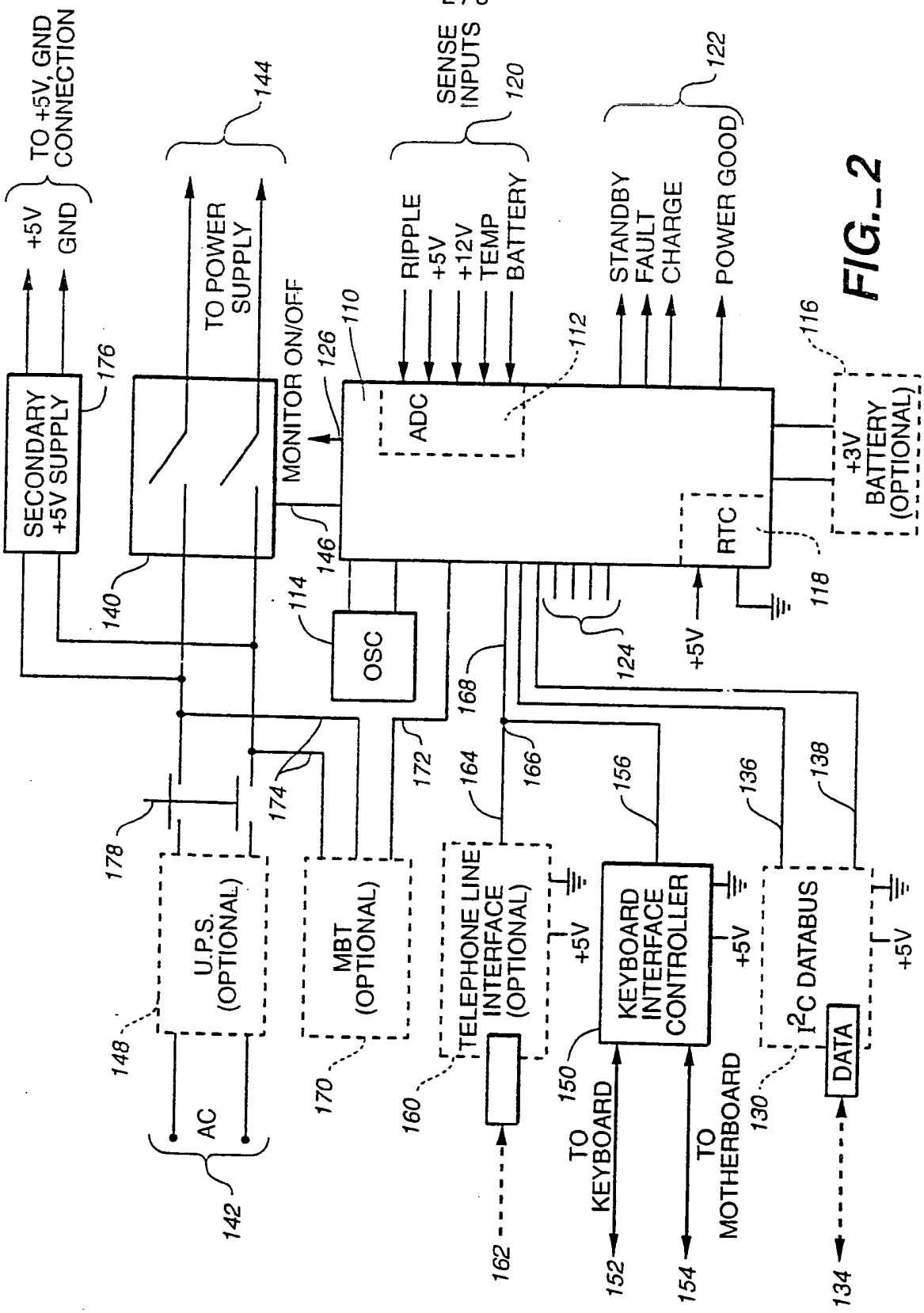
TO +5V, GND CONNECTION
+5V
GND
SECONDARY +5V SUPPLY
176
TO POWER SUPPLY
144
SENSE INPUTS
120
RIPPLE
+5V
+12V
TEMP
BATTERY
122
STANDBY
FAULT
CHARGE
POWER GOOD
MONITOR ON/OFF
126
110
ADC
112
116
+3V BATTERY (OPTIONAL)
RTC
118
140
146
114
OSC
124
+5V
168
172
164
166
156
136
138
178
174
U.P.S. (OPTIONAL)
MBT (OPTIONAL)
TELEPHONE LINE INTERFACE (OPTIONAL)
KEYBOARD INTERFACE CONTROLLER
I2C DATABUS
+5V
148
170
160
150
130
AC
142
162
TO KEYBOARD
TO MOTHERBOARD
DATA
152
154
134

FIG._2

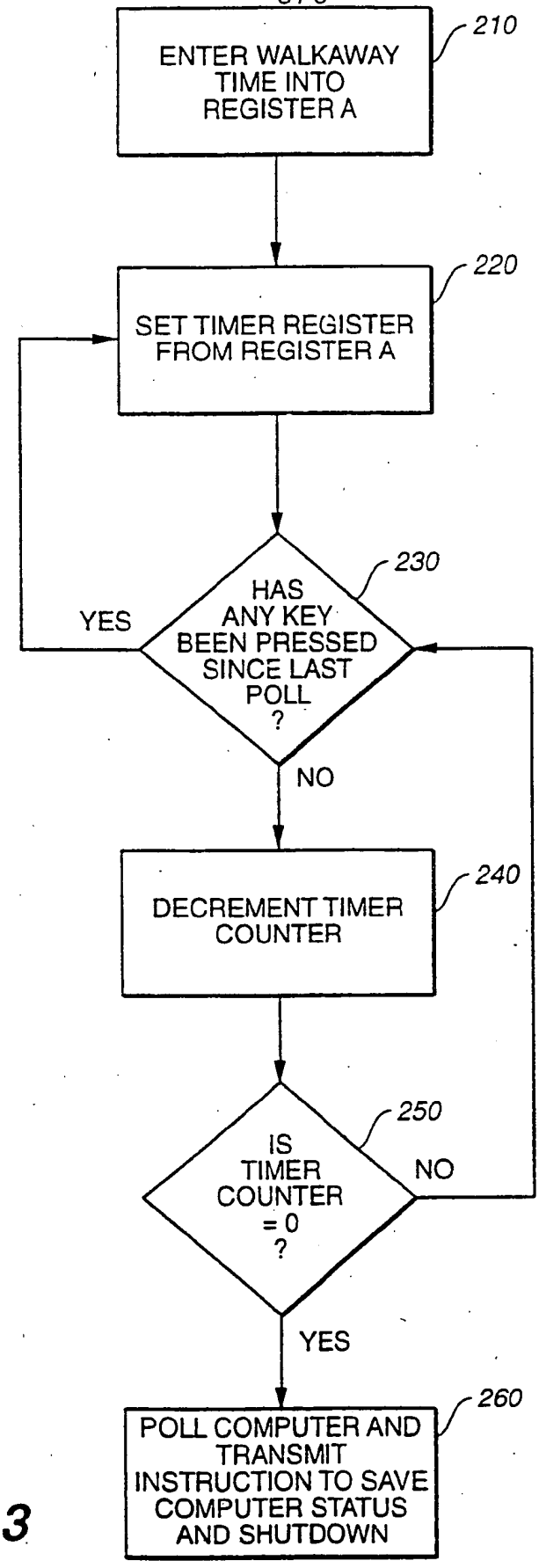
ENTER WALKAWAY TIME INTO REGISTER A
210
SET TIMER REGISTER FROM REGISTER A
220
HAS ANY KEY BEEN PRESSED SINCE LAST POLL ?
230
YES
NO
DECREMENT TIMER COUNTER
240
IS TIMER COUNTER = 0 ?
250
NO
YES
POLL COMPUTER AND TRANSMIT INSTRUCTION TO SAVE COMPUTER STATUS AND SHUTDOWN
260

FIG._3

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 93/00575

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 G06F1/26

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	G06F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X	DE,A,4 014 683 (JESCHKE K.) 21 November 1991 see column 1, line 51 - line 58 see column 3, line 4 - line 17 see column 4, line 21 - column 5, line 44; figure 1	1-3,14
Y		4-12, 15-20

Y	IBM TECHNICAL DISCLOSURE BULLETIN vol. 32, no. 9B, February 1990, NEW YORK US pages 125 - 129 'CONTROL PANEL FOR MODELS OF AS/400' see page 125, line 1 - page 127, line 20 see page 128, line 11 - line 15 see page 128, line 42 - page 129, line 35	4,6,7, 9-11, 15-18
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° Special categories of cited documents : [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
03 AUGUST 1993	06.08.93
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	BAILAS A.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
Y	US,A,4 626 844 (MANN B. L.) 2 December 1986 see abstract	5,10
Y	EP,A,0 303 020 (SHARP KABUSHIKI KAISHA) 15 February 1989 see column 2, line 9 - line 45; figure 2	8,19
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Y	HEWLETT-PACKARD JOURNAL vol. 37, no. 7, July 1986, PALO ALTO US pages 4 - 13 EATON J. T. 'Design of HP's Portable Computer Family' see page 5, line 40 - line 51 see page 7, line 45 - line 57 see page 10, line 24 - line 26	12,20
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E	WO,A,9 307 558 (NATIONAL RESEARCH COUNCIL OF CANADA) 15 April 1993 see page 3, line 4 - page 4, line 30 see page 9, line 27 - page 12, line 8 see page 16, line 16 - line 28 see page 23, line 7 - line 31	1-3,6,8, 12,14, 17,19,20

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB 9300575 SA 72602

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 03/08/93
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A-4014683	21-11-91	None	
US-A-4626844	02-12-86	None	
EP-A-0303020	15-02-89	JP-A- 63314133	22-12-88
		US-A- 4901243	13-02-90
WO-A-9307558	15-04-93	None	